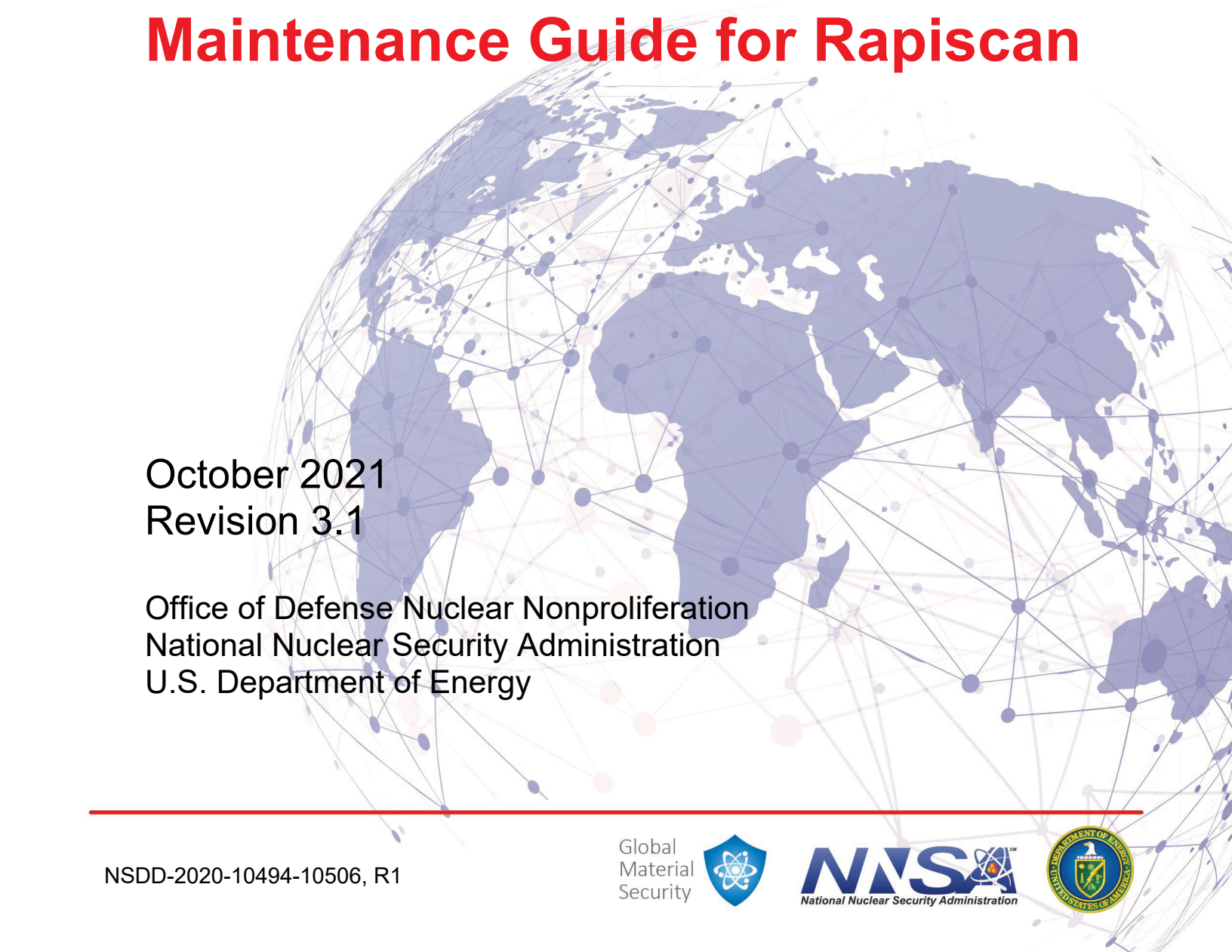
NSDD
NUCLEAR SMUGGLING DETECTION AND DETERRENCE

Radiation Portal Monitor
Maintenance Guide for Rapiscan



October 2021
Revision 3.1

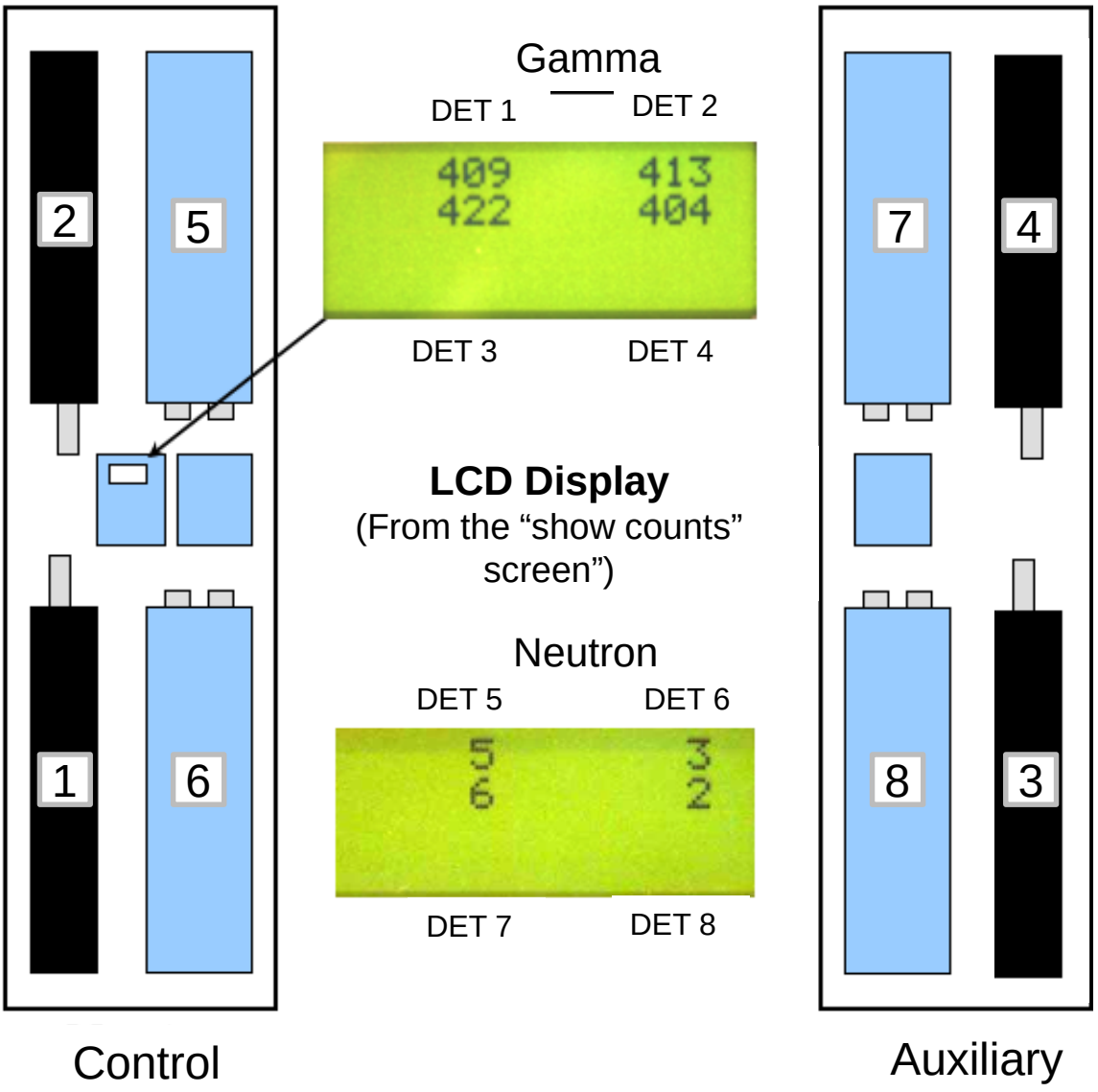
Office of Defense Nuclear Nonproliferation
National Nuclear Security Administration
U.S. Department of Energy

NSDD-2020-10494-10506, R1

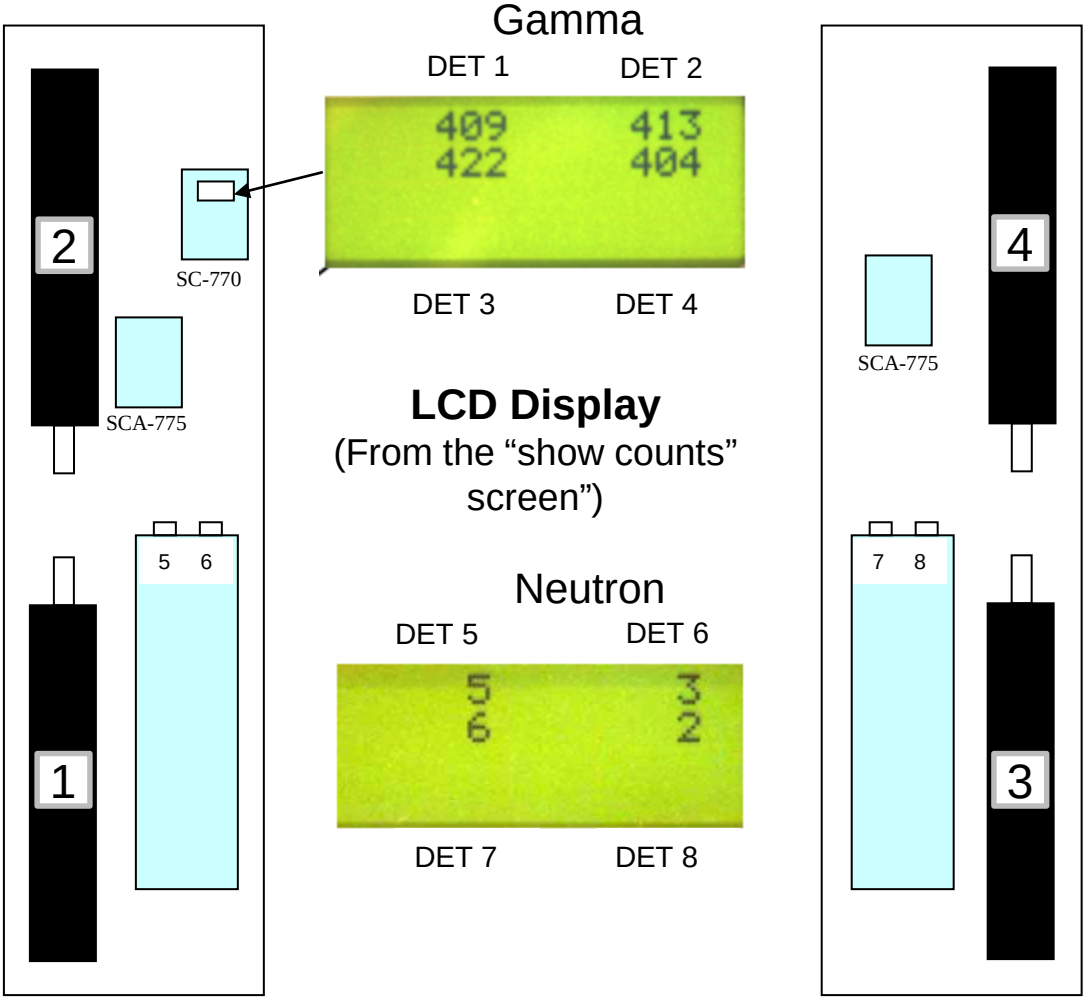
Global Material Security

National Nuclear Security Administration

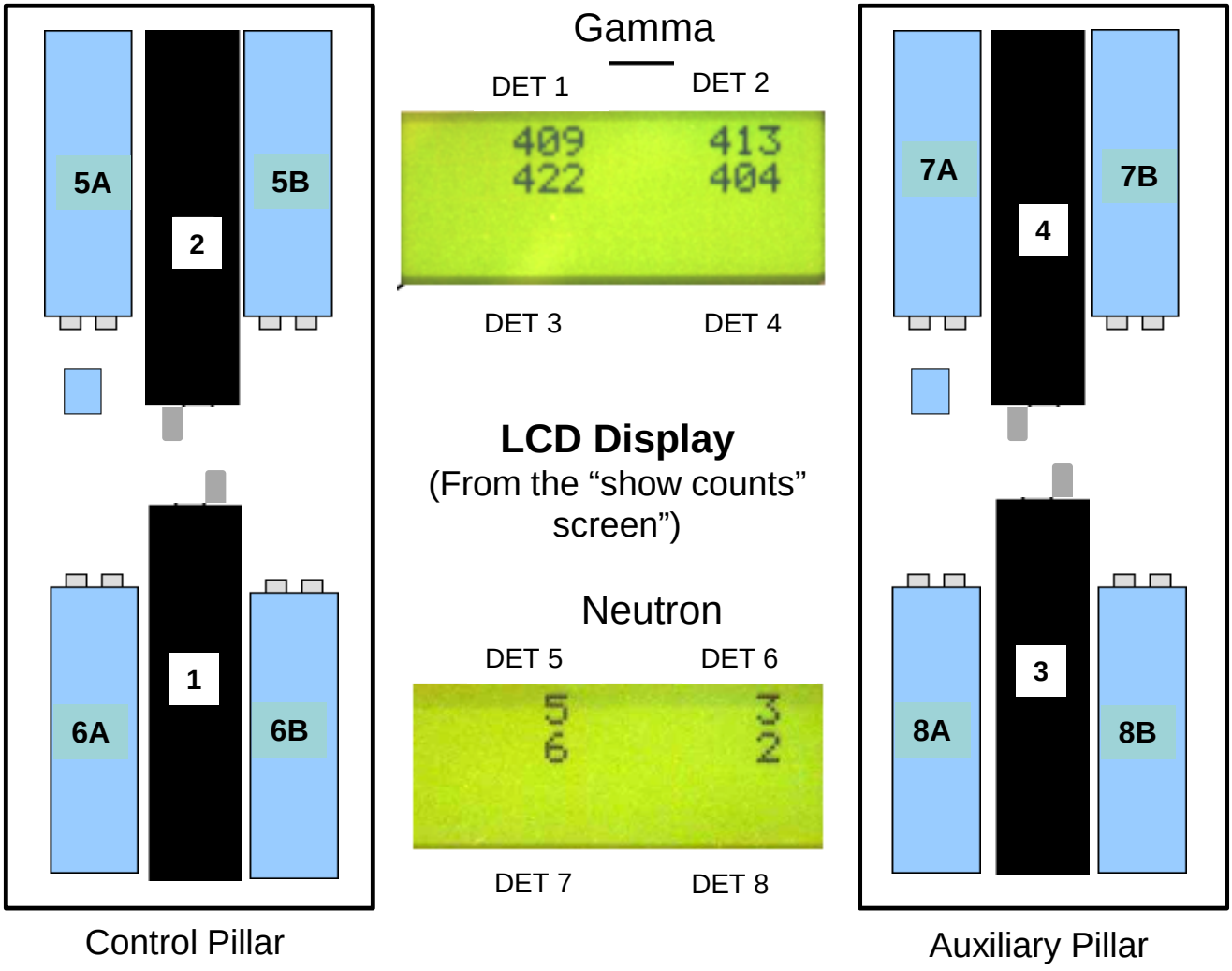
TSA VM250AGN
Detector Layout



TSA PM700AGN
Detector Layout



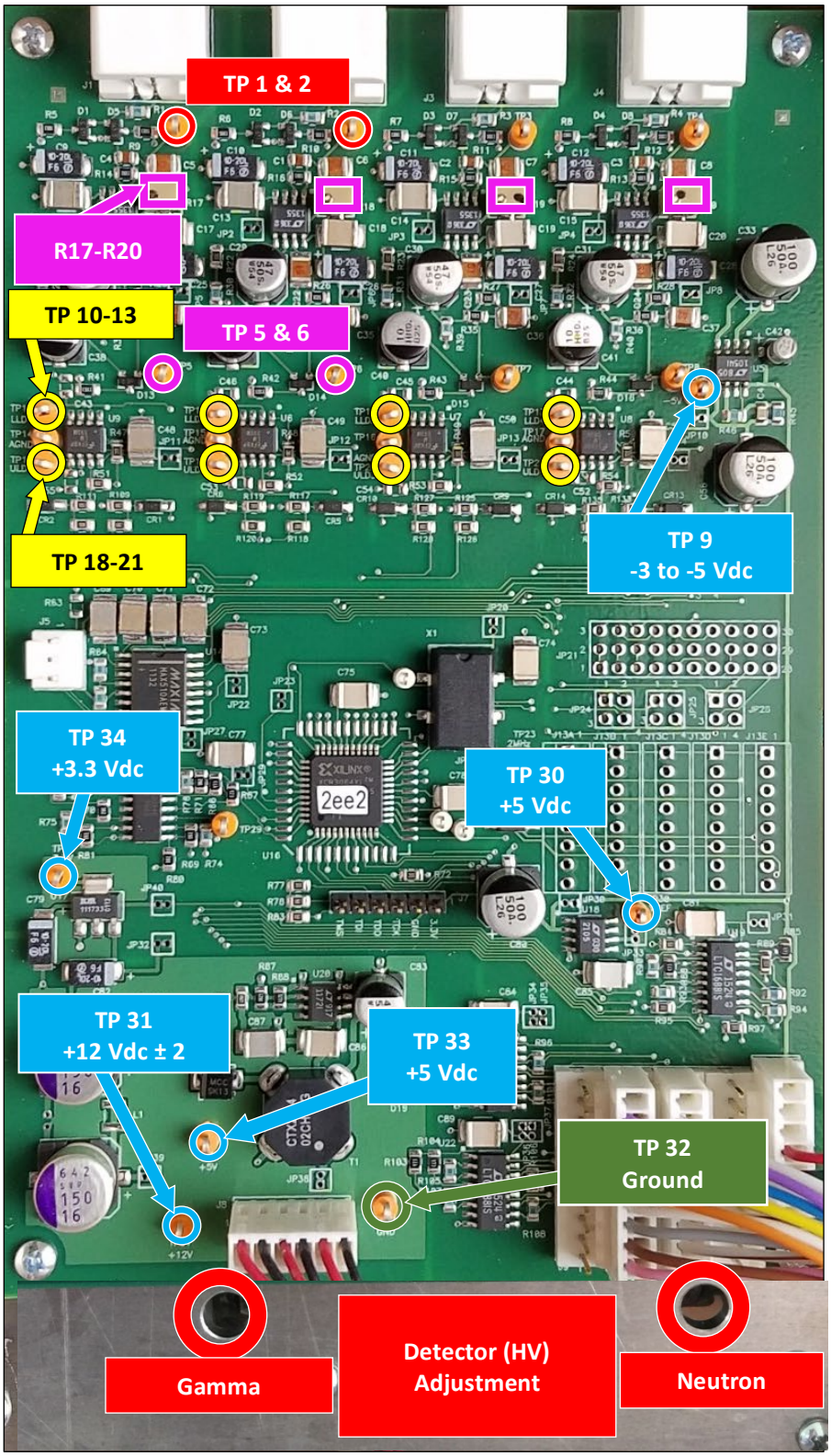
TSA TM-850
Detector Layout



Control Pillar

Auxiliary Pillar

Single Channel Analyzer Board (SCA-774)



NSDD-2018-298-302

		Controller Label	FCT Spreadsheet Label	Values
GAMMA	PARAMETERS	HI/LO LEVELS	Low Background Fault/Hi Background Fault	1/2 of lowest Det, 3x highest Det
		INTERVALS	Intervals (200 ms)	5
		OCC. HOLDIN	Occupancy Hold-in (5 for Ped monitors, 10 from Vehicle and Rail monitors)	5 or 10
		NSIGMA	N*Sigma	Calculated value
		DET. ONLINE	Detectors on line	1234
	FUNCTIONS	SHOW COUNT	Displays count rates for all gamma detectors	
		DSCR. ADJUST	(LLD) Lower level discriminator (M/S) - (ULD) Upper level discriminator (M/S)	LLD=0.069 / ULD=0.455
		VARIANCE	Runs a "variance test" when selected	
		SET CLOCK	*not listed on FCT* Allows user to enter current date and time	local time/date
		RELAY OUTPUT	Relay Output (Determines if visual and audible fault/alarm indications function)	1
	ADVANCED	ALGORITHM	Algorithm (VM and TM = 1010, PM = 1000)	1010 or 1000
		G-BKG. TIME	Gamma BG averaging time, sec	20
		SHOW VERSION	Firmware version	1.10.1a
		CLEAR G-COUNTS	*not used - not listed on the FCT*	
		F-ALARM TEST	*not used - not listed on the FCT*	
		BKG. NSIGMA	Background N*Sigma	0
		SYSTEM I.D.	*not used - not listed on the FCT*	
		PROFILING	Profiling	ON
NEUTRON	PARAMETERS	HI LEVEL	High background fault level	50
		MAX INTRVALS	Max intervals	Calculated value
		ALPHA VALUE	Alpha value (47 unless bkd in TM less than 10cps, VM less than 5)(PM = 5)	Calculated value
		ZMAX VALUE	Zmax value	1200
		SEQ. TEST	Sequence number	Calculated value
		N-BKG TIME	Neutron BG averaging time, sec	120
	FUNCTIONS	SHOW COUNT	Displays count rates for all neutron detectors	
		DSCR. ADJUST	Lower level discrimination (M/S) - Upper level discrimination (M/S)	0.504 / 5.04
		CLEAR N-CNTS	*not used - not listed on the FCT*	
		NEU. ENABLE	Neutron enable	ON
COMMUNICATIONS	PARAMETERS	IP	IP Address	CAS SPECIFIC
		SUBNET	Subnet Mask	255.255.255.000
		DNS	*not listed on FCT*	
		GATE WAY	*not listed on FCT*	

	Do not change
	Not a "setting"

Rapiscan RPM Streaming Data/Daily File Definitions

1. Main character identifiers

GA	Gamma Alarm		**NA**	Neutron Alarm
GB	Gamma Background		**NB**	Neutron Background
GH	Gamma High (Fault)		**NH**	Neutron High (Fault)
GL	Gamma Low (Fault)		**NS**	Neutron Scan
GS	Gamma Scan			
GX	Occupancy Cleared			

TC	Tamper Cleared		**SG1**	Setup Gamma 1
TT	Tamper Fault		**SG2**	Setup Gamma 2
SP	Speed Message		**SG3**	Setup Gamma 3
			SN1	Setup Neutron 1
			SN2	Setup Neutron 2

2. Main character definitions

a. GA,xxxxx,xxxxx,xxxxx,xxxxx

Gamma counts sent every 200 milliseconds while occupied and in an alarm state. The counts shown are per 200-millisecond NOT counts/second.

b. GB,xxxxx,xxxxx,xxxxx,xxxxx

Gamma Background sent every 5 seconds when RPM not occupied. Displays one-second average count rate in counts/second.

c. GH,xxxxx,xxxxx,xxxxx,xxxxx

Gamma High Fault, sent every 5 seconds. The counts shown are counts/second, but based on four 5-second rolling averages.

d. GL,xxxxx,xxxxx,xxxxx,xxxxx

Gamma Low Fault, sent every 5 seconds. The counts shown are counts/second, but based on four 5-second rolling averages.

e. GS,xxxxx,xxxxx,xxxxx,xxxxx

Gamma counts sent every 200 milliseconds while occupied and not in an alarm condition. The counts shown are per 200-millisecond NOT counts/second.

f. GX,xxxxxx,yyyyyy,000000,000000
Pillar occupancy(x) and neutron background count(y) since midnight. Count is incremented every occupancy. Automatically resets to zero on a power cycle and at midnight.

g. NA,xxxxx,xxxxx,xxxxx,xxxxx
Neutron counts sent every second while occupied and in an alarm state. The counts are counts/second averaged from five 200-millisecond count buffer.

h. NB,xxxxx,xxxxx,xxxxx,xxxxx
Neutron Background sent every 5 seconds. The one-second counts are averaged from a 20-second count buffer. The 20 second buffer is based on four 5-second rolling averages.

i. NH,xxxxx,xxxxx,xxxxx,xxxxx
Neutron High Fault Background sent every 5 seconds. The one-second counts are averaged from a 20-second count buffer. The 20 second buffer is based on four 5-second rolling averages.

j. NS,xxxxx,xxxxx,xxxxx,xxxxx
Neutron counts sent every second while occupied and not in an alarm state. The counts are one second, from five 200-millisecond count buffer.

k. TC,111111,111111,111111,111111
Tamper or power-fail condition cleared. This is sent only once when the AC power is restored, or when the cabinet doors are closed.

l. TT,000000,000000,000000,000000
Tamper or power-failure condition. This is sent only upon AC power loss, +15 VDC power supply failure, or when the doors are opened on the RPM cabinet.

m. SP, 0.1234, 04.234, 006.23, 000000
Speed Message, The first field is time to cover 1 foot, second field is MPH (99 max), Third field is kPH (999 max).

3. Ethernet Output Only

The following messages are sent on RPM power up if there is an Ethernet link established, when the program mode is exited, and at midnight based on the SC-770 internal clock.

a. SG1,005000,000068,05,10,07.00,P
Setup Gamma 1,
High Background fault set point (cps)
Low Background fault set point (cps)
Intervals,
Occupancy holdin,
NSigma,
“P” a place holder.

b. SG2,1100,0.068,0.455,1,1010,A (or T)

Setup Gamma 2,
Detectors on line,
Control Lower level discriminator,
Control Upper level discriminator,
Relay output,
Algorithm,
"A or T" is part of the Version of software 1.10.0**A** or 2.00.0**T**

c. SG3, 0.068,0.455,020,000,1.10.0

Setup Gamma 3,
Auxiliary Lower level discriminator,
Auxiliary Upper Level discriminator,
Background Time,
Background NSigma,
Rabbit Firmware Version.

d. SN1,000050,2,0047,1200,4,120

Setup Neutron 1,
High background fault set point,
Maximum Intervals,
Alpha value,
Zmax value,
Sequential intervals.

Establishing communications with a TSA RPM SC-770 Controller

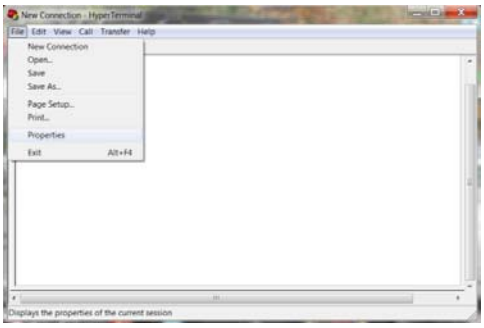
Two part process:

1. Set up Hyperterminal connection
2. Configure a connection in your “Network and Sharing Center”

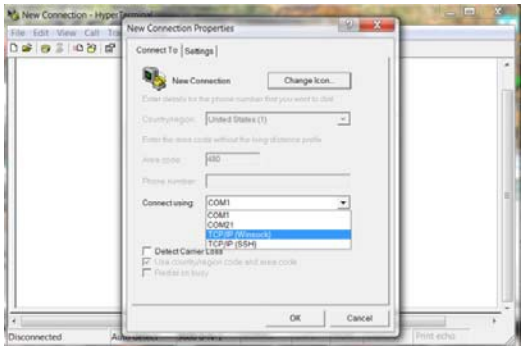
A. Set up Hyperterminal connection

A.1. Open a “New Connection” in HyperTerminal (it will ask you to name it, I use “TSA”)

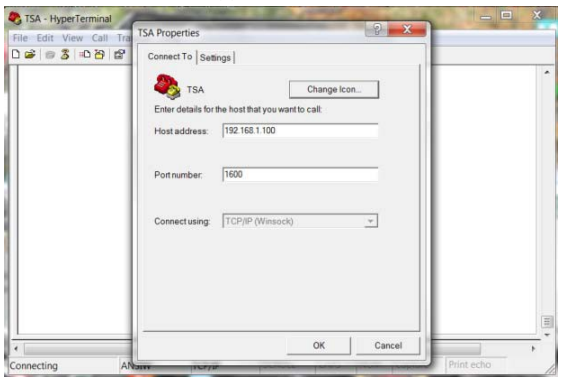
A.2. Go to “File”> “Properties”



A.3. in “Connect using” drop down menu > select “TCP/IP (Winsock)”



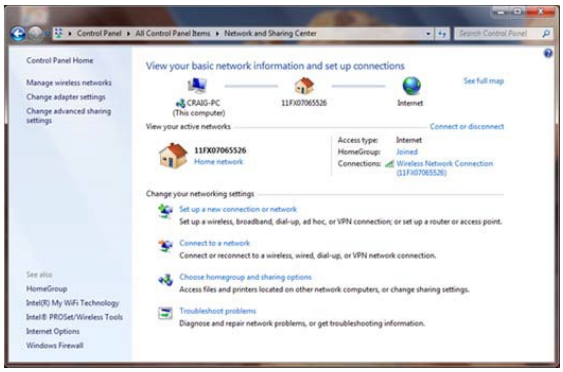
A.4. This window will appear, Type in the IP address of RPM Controller, and Port 1600
Example: if controller is 192.168.001.100, type in 192.168.1.100



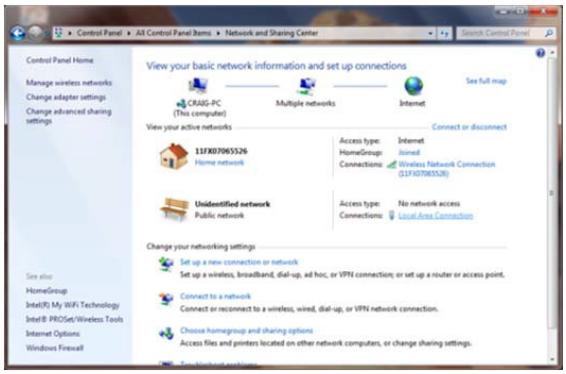
A.5 Click OK, and minimize the HyperTerminal window temporarily

B Time to configure a connection on your computer

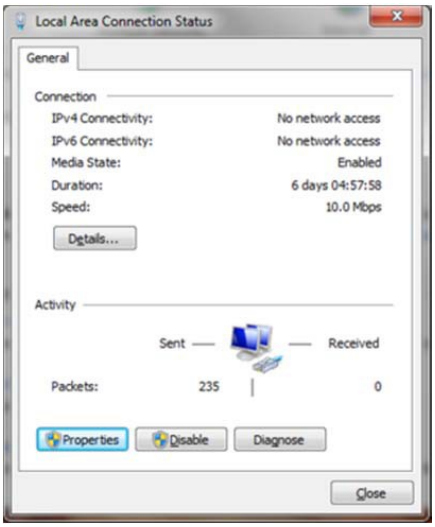
B.1 Navigate to Control Panel > Network and Sharing Center, you'll see any active networks you are connected to. Plug in the Ethernet connector at the SC-770 and into your computer.



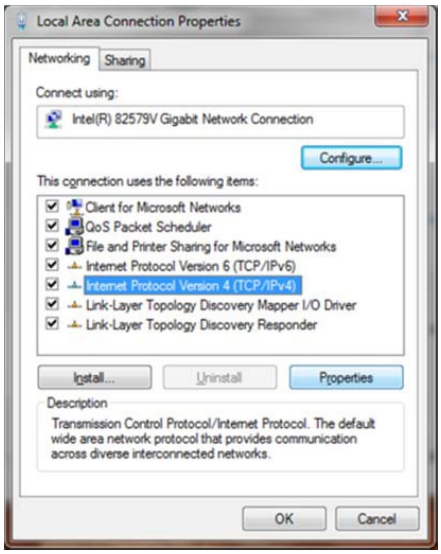
B.2 You should see a new network appear, and eventually the "Active Networks" will show an "Unidentified Network", Click on the "Local Area Connection" link next to it.



B.3 The status window for that connection will open as seen below, click on Properties.

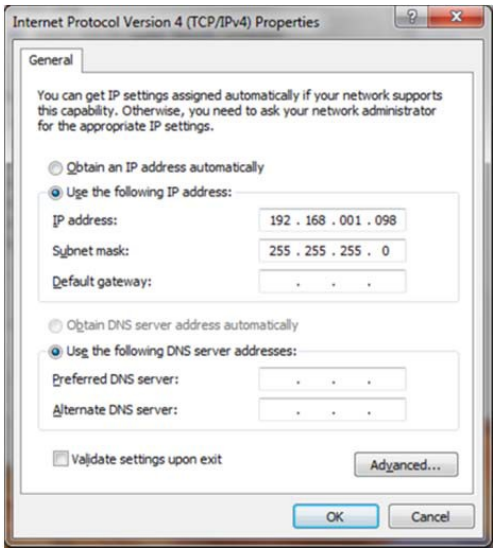


B.4 The following window will open, highlight (click on) Internet Protocol Version (TCP/IPv4), then click on "OK".



B.5 The following window will open, Select "Use the following IP address, and type in a IP address that is slightly different from the IP address of the RPM controller only in the last three digits.

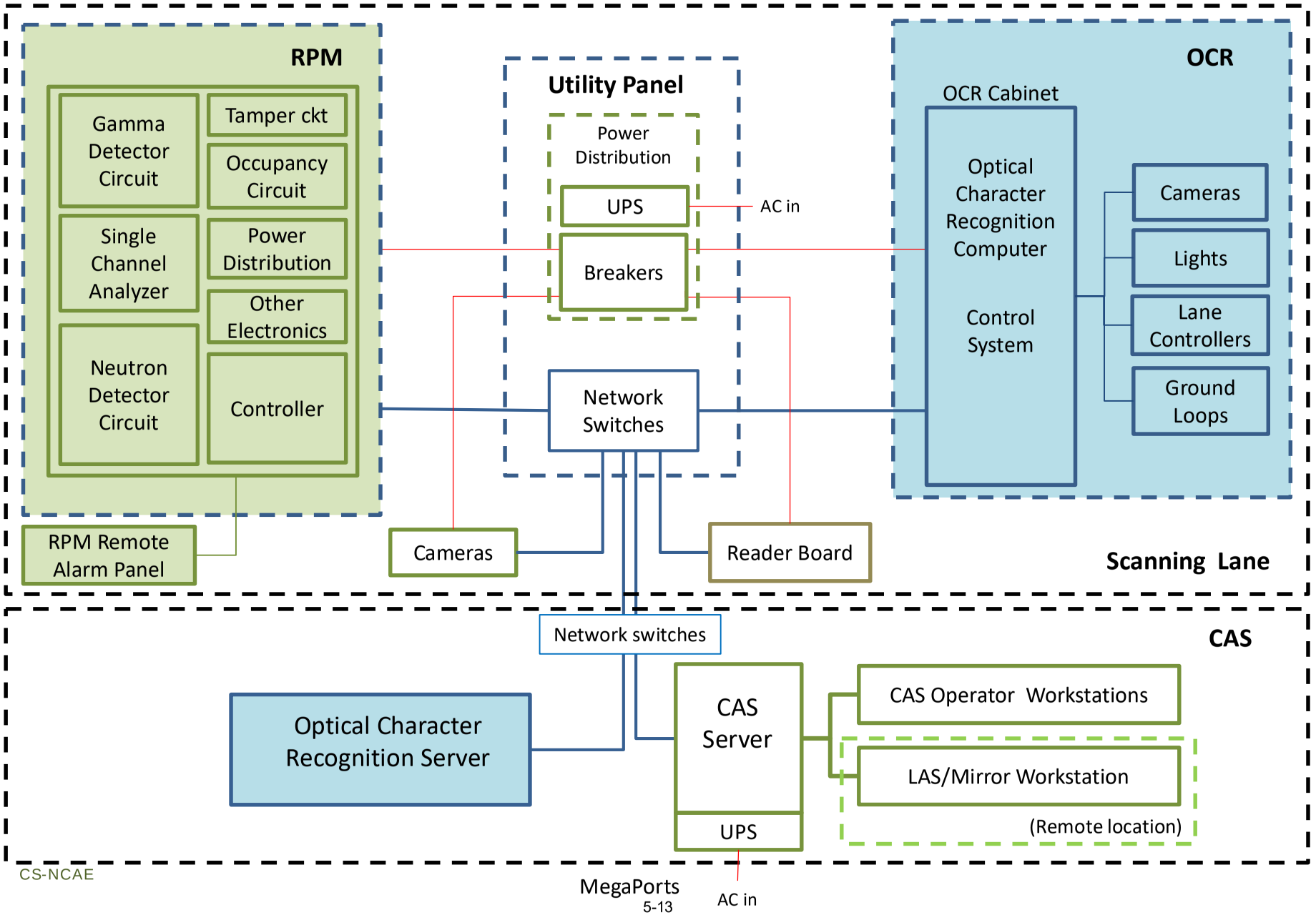
Example if RPM IP address is 192.168.001.100, type in 192.168.001.098, then fill in Subnet mask as indicated below. Click OK, back all of the way out, and you should be good to go.



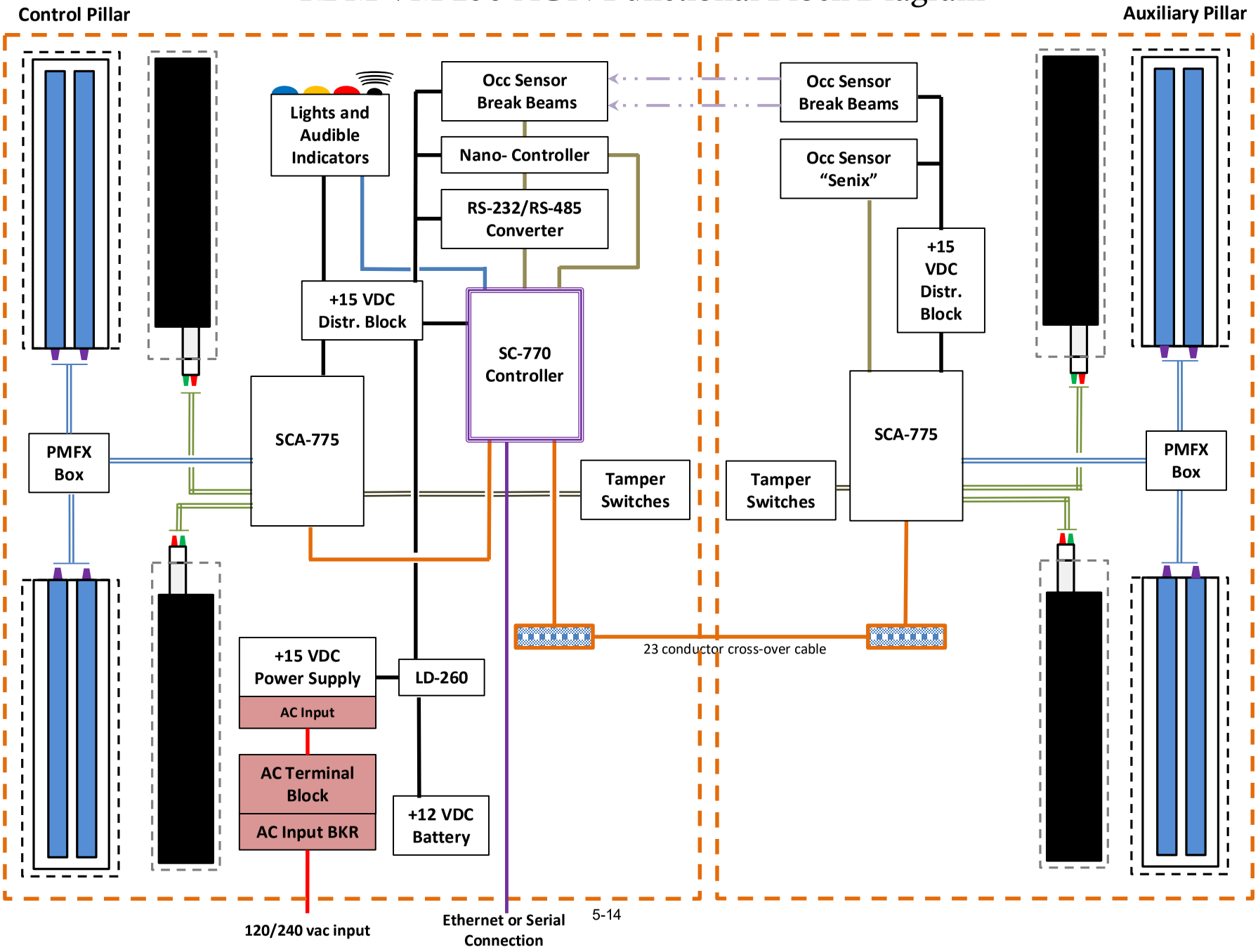
TSA VM-250 AGN
Functional Block Diagrams

- Radiation Detection System Overview
- TSA VM250-AGN Overview
- Gamma Detector Circuitry
- Neutron Detector Circuitry
- 120/240 VAC Distribution
- +15 VDC Distribution
- Occupancy Sensor Circuit
- Tamper Circuit (and line drawing)
- Alarm and Fault Indication Circuit

Radiation Detection System



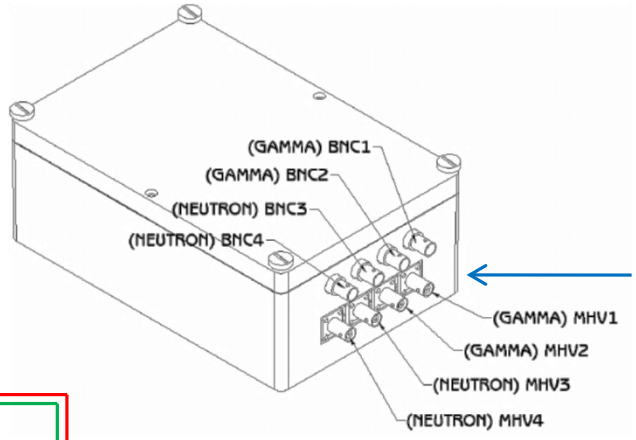
RPM VM-250-AGN Functional Block Diagram



Gamma Detection Circuitry Functional Block Diagram

Control Pillar

Auxiliary Pillar



SCA-775
Module Detail

MHV = High Volts (Back Row)

BNC = Signal (Front Row)

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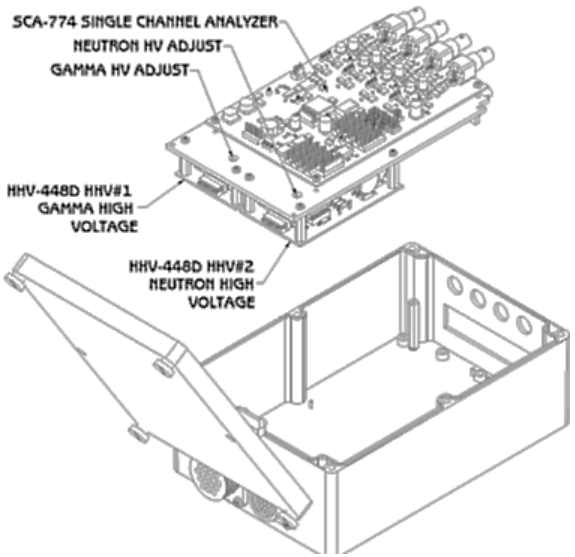
VD-580 Voltage Divider

VD-580 Voltage Divider

SCA-775

SCA-775

SC-770



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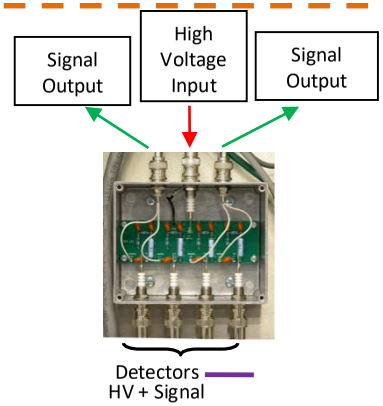
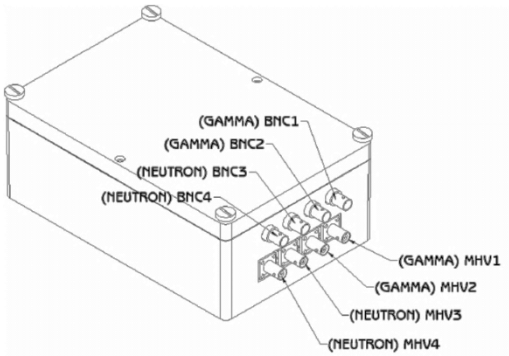
Neutron Detection Circuitry Functional Block Diagram

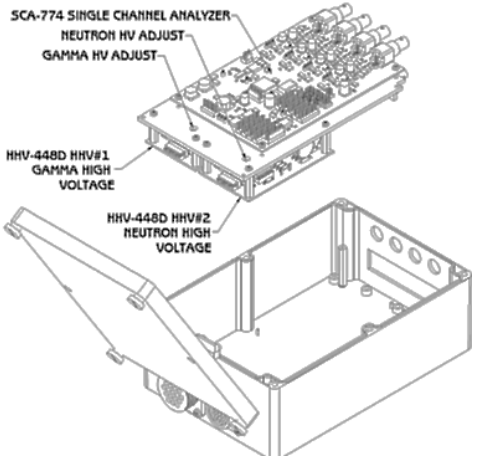
Control Pillar

Auxiliary Pillar





SCA-775
Module Detail
MHV = High Volts (Back Row)
BNC = Signal (Front Row)



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PMFX Box

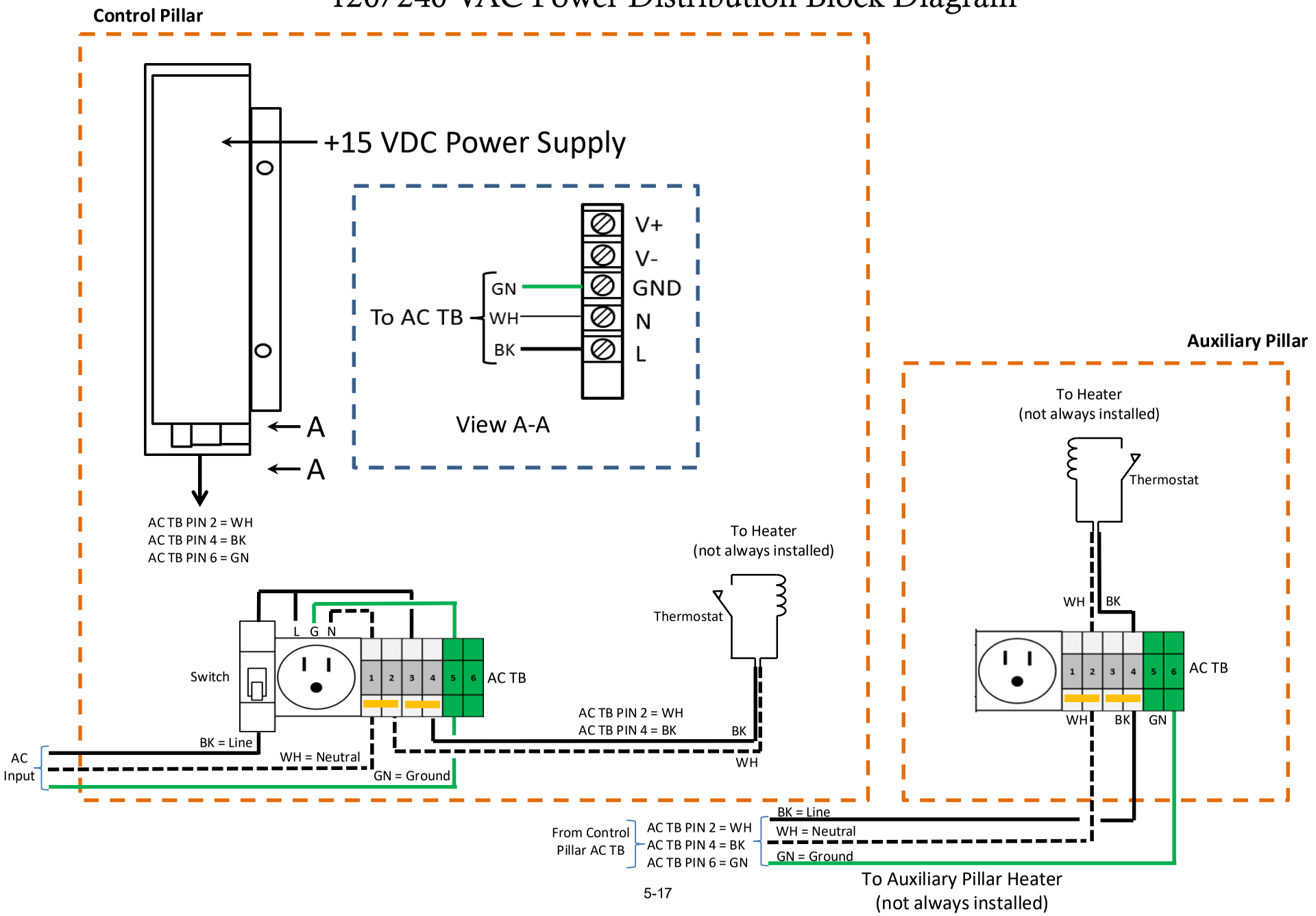
SCA-775

SC-770

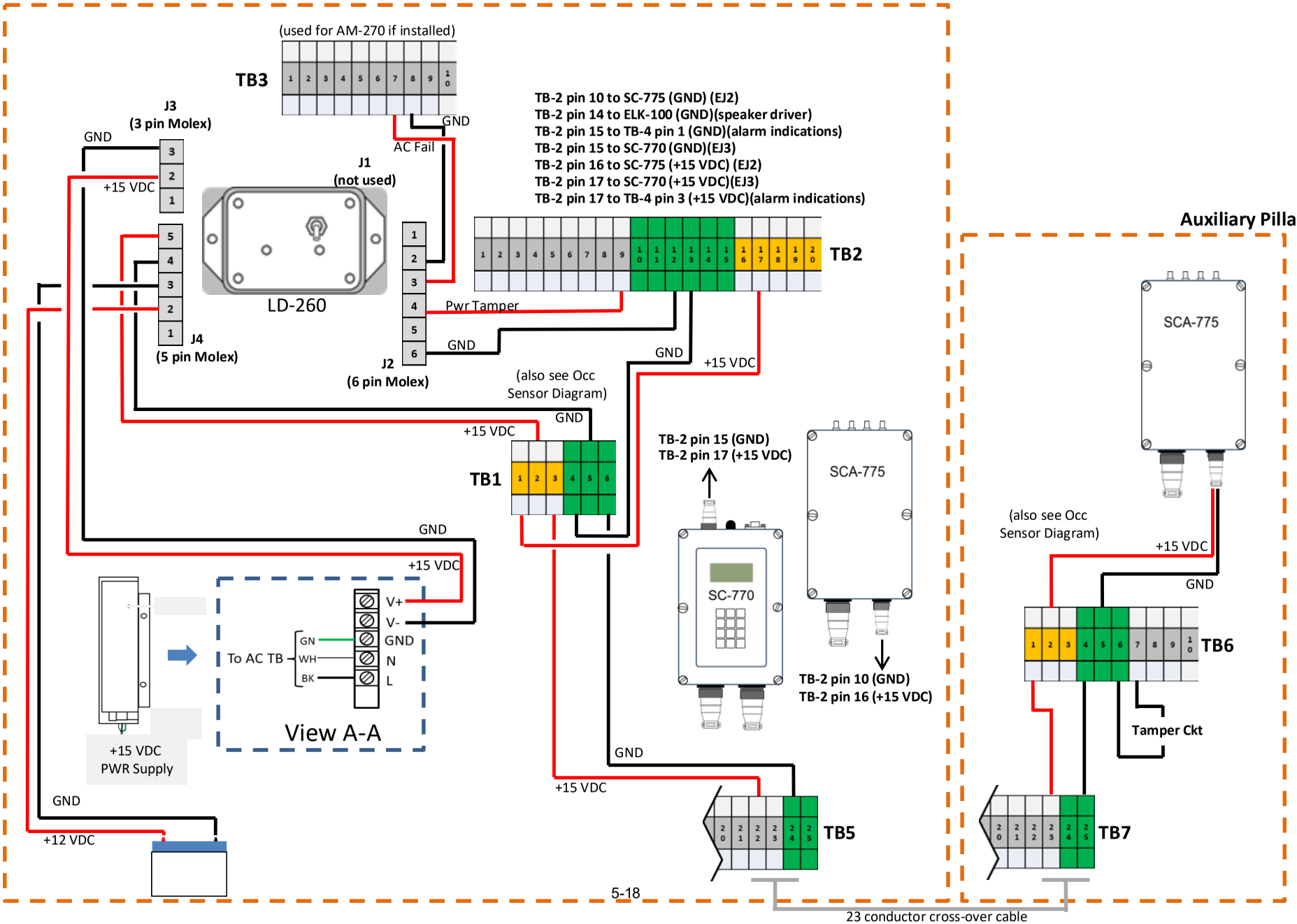
PMFX Box

SCA-775

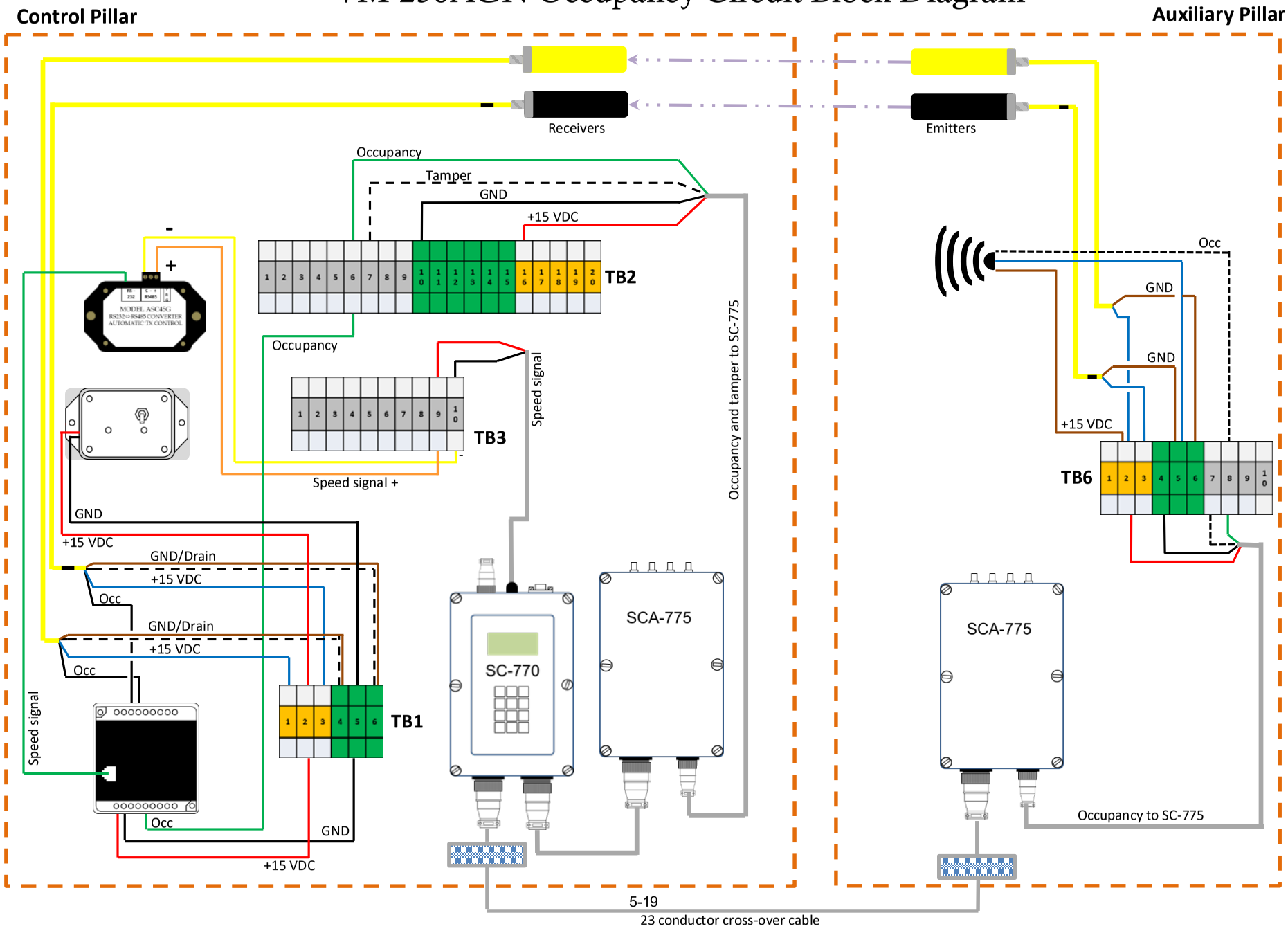
120/240 VAC Power Distribution Block Diagram



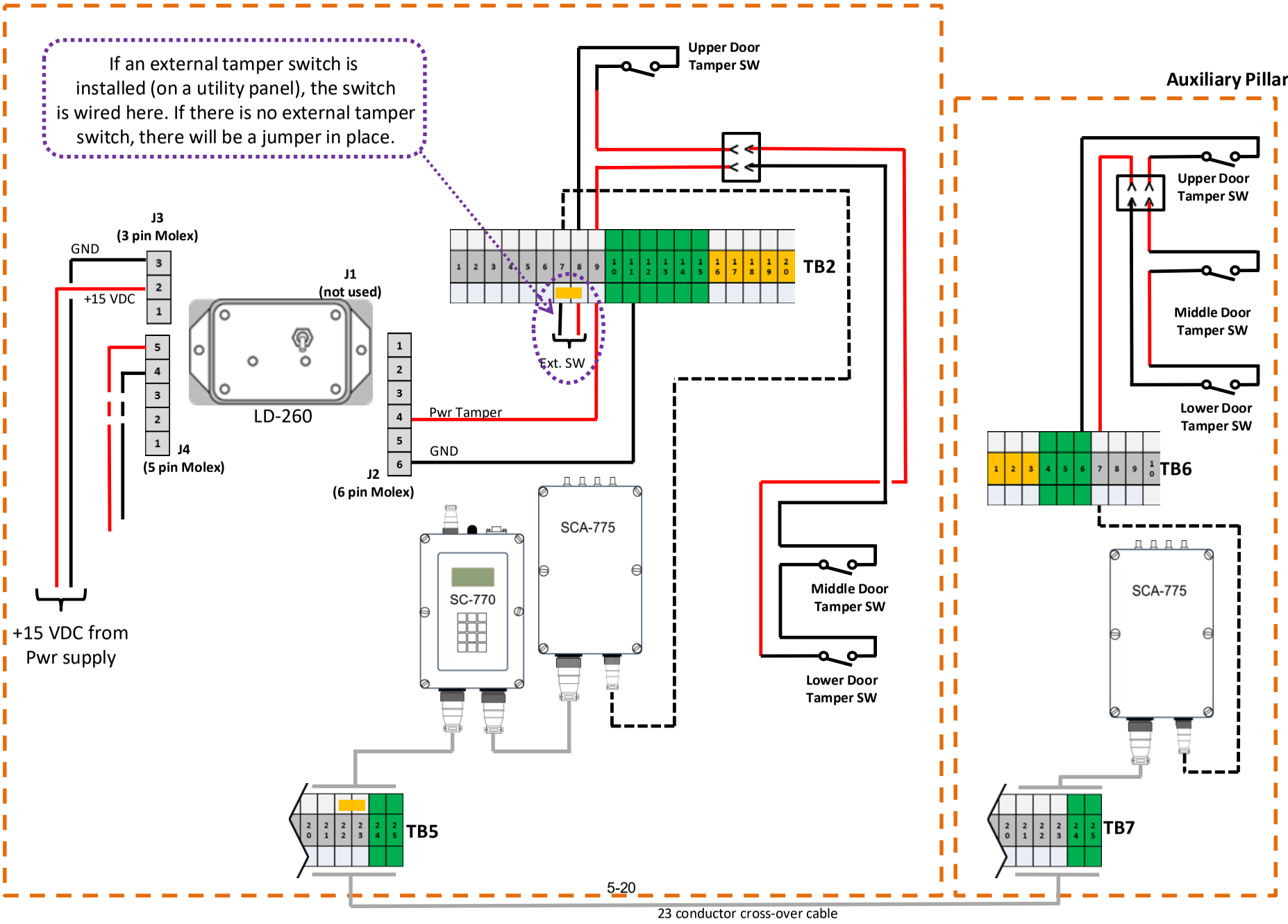
+15 VDC Power Distribution Block Diagram



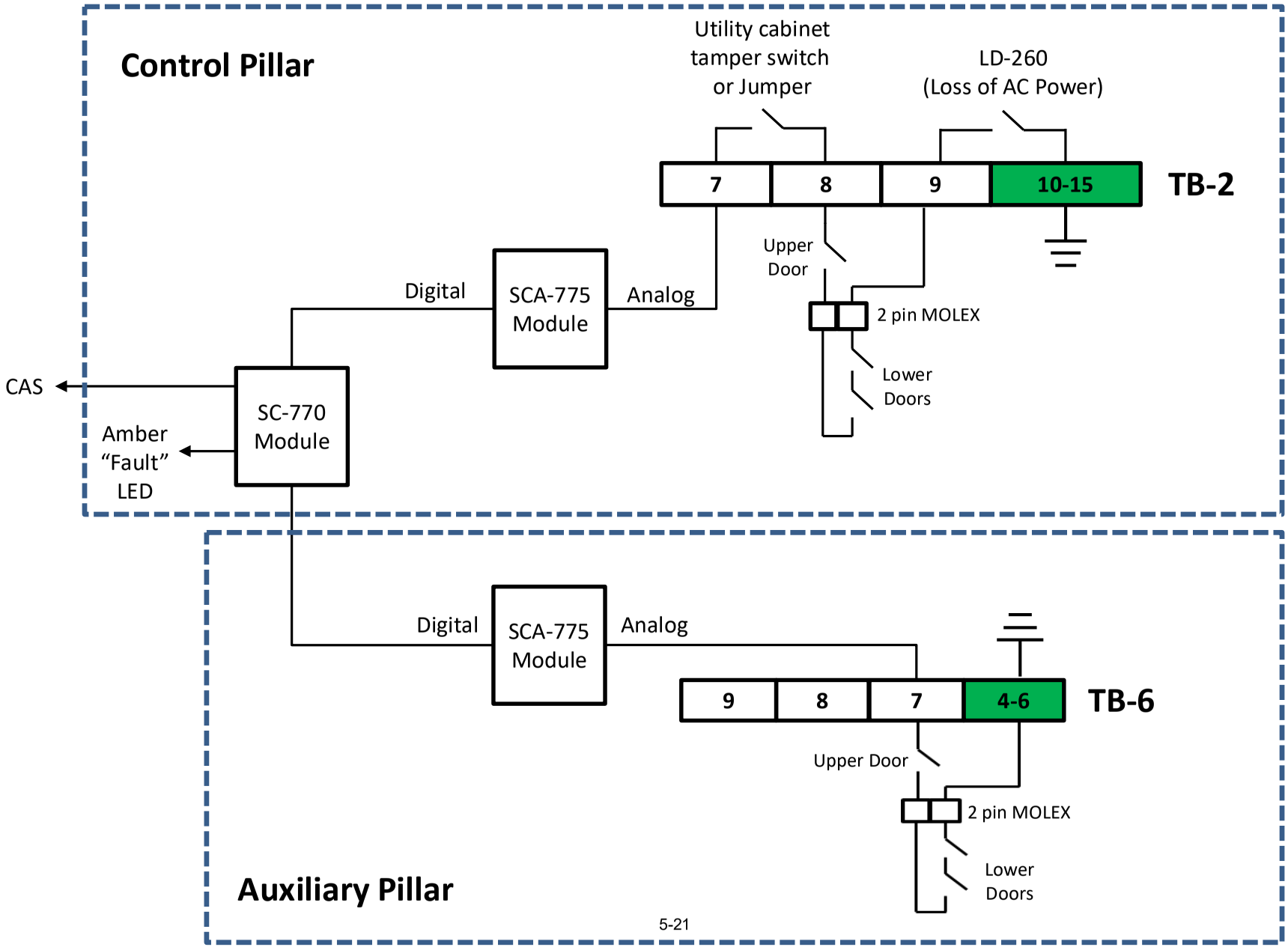
VM-250AGN Occupancy Circuit Block Diagram



VM250-AGN Tamper Circuit Block Diagram



VM-250 AGN Tamper Circuit Line Drawing



VM250-AGN Alarm/Fault Indication Circuit Block Diagram